REMARKS/ARGUMENTS

Election/Restriction

In a telephone conference with Examiner Menon on 6/26/03, Thomas R. Williamson III, attorney for Applicant, provisionally elected to prosecute invention Group I, Claims 1-19 and 24, with traverse.

Applicant hereby affirms the provisional election, with traverse, to prosecute Group I claims, namely, Claims 1-19 and 24. There is no change to inventorship.

Examiner has withdrawn Claims 20-23 as drawn to non-elected invention, Group II.

Section 102(b) Rejection

Examiner has rejected Claim 24 as being clearly anticipated by Williamson (U.S. Pat. No. 5,443,724). Applicant respectfully traverses Examiner's rejection and requests Examiner to consider the following arguments.

> Typically, when two filters are utilized for removal of water from fuel, the first filter is **hydrophilic** to absorb the water until enough water agglomerates to form large droplets. If emulsified water is present in the fuel, it is held in emulsion by a surfactant having a **hydrophilic** end that attaches to the water, and a **hydrophobic** end that extends outward. **Hydrophilic** filter media do not attract the **hydrophobic** end of the surfactant, and thus the water will pass through the filter unimpeded. The emulsified water will remain in suspension and pass the second filter thereby continuing to contaminate the fuel.

In Applicant's invention, the first filter is **hydrophobic**, thereby attracting the **hydrophobic** end of the surfactant, until enough water coagulates to form micron-size droplets. Because larger droplets have now formed, they may be removed by the second filter.

In the Williamson '724 patent, it is the surface energy of the discontinuous phase (water) that is of importance relative to the surface energy of the filter media, and not the surface energy of the surfactant. Furthermore, Applicant's invention is drawn only to the specific energy of the hydrophobic functional group of the surfactant. This is not taught by Williamson '724.

The Williamson '724 patent accomplishes its agglomeration of water by the choice of physical shape of the packing material in order to tailor the surface energy. Williamson '724 functions by mere agglomeration of large, entrapped, adjacent water droplets, while Applicant's invention functions by attraction of highly emulsified sub-micron-size water droplets with a surfactant-coating, wherein the hydrophobic functional group of the surfactant is attracted to the filter media. The surfactant boundary then breaks down which allows micron-size water droplets to form.

The Williamson '724 patent discloses an agglomerating apparatus, wherein the emulsified water with fuel passes through a coalescing filter element, and wherein the emulsified water forms water droplets large enough to settle out from the fuel by gravity. Fuel passes through a 100 x 100 mesh, but the larger water droplets do not, thereby allowing the larger water droplets to settle out via gravity. There is nothing in the Williamson '724 patent that suggests its use in removing micron-size water emulsions from fuel. To utilize the Williamson '724 teachings, would be to permit the passage of highly emulsified water through the second filter into the clean fuel permeate, teachings contrary to the objectives of Applicant's invention.

Specifically, in Applicant's invention, water droplets are sub-micron-size and remain in an emulsified state after passing through the coagulating filter. The water droplets coagulate to form micron-size emulsified water droplets that are still small enough that a water emulsion is maintained in the fuel after passing through the first filter. Thus, the emulsified micron-size water droplets of Applicant's invention will not settle out from the fuel by gravity at their concentration level on the membrane filter. Once swept off the second filter by the cross flow, the micron-size water emulsion reaches the settling chamber, where some of the micron-size water droplets will agglomerate to form larger droplets and settle out once the water concentration in the emulsion reaches a sufficiently high level, while other micron-size droplets recirculate to the first stage filter.

Summary

In view of the fact that, inter alia, Williamson '724 does not teach a dead-end filter and a cross-flow filter, does not teach to the surface energy of the hydrophobic functional group of the surfactant, nor to the surfactant itself, and would, as described, permit highly emulsified water to pass through into the clean fuel permeate in contrast to Applicant's invention, Applicant respectfully submits that Applicant's invention distinguishes over Williamson '724, and Claim 24 is in condition for allowance.

Section 103(a) Rejections

Examiner has rejected Claims 1-10, 18 and 19 over Williamson '724 in view of Sweet (U.S. Pat. No. 4,978,454). Applicant respectfully traverses Examiner's rejection and requests Examiner to consider the following arguments.

Examiner stated that Williamson '724 utilizes a cross-flow filter (reference #30). Applicant respectfully asserts that this is incorrect. Williamson '724 does not utilize a cross-flow filter, as does Applicant's invention. In fact, Williamson '724 teaches two dead-end filters in series (FIG. 3A, #20 and #30) with a flow direction in the first filter from inside to outside and a flow direction in the second filter from outside to inside. Placing different types of filter elements with different flow patterns in the same filter arrangement can have different functional results. Applicant's invention is a hydrophobic dead-end filter followed by a hydrophobic cross-flow membrane filter. The first filter flow direction is from inside to outside, but the flow in the second filter is bi-directional, with the permeate flowing from outside to inside and the retentate flowing in one end and out the other end. Further, Williamson does not teach separate enclosures for series filter elements.

In the process disclosed in the Sweet '454 patent, the settling tank and the membrane separator must work together to separate a heavier phase from a light phase. The retentate from the membrane separator is sent back to the settling tank (at the bottom). The permeate from the membrane separator is also sent back to the settling tank (at the top). The lighter fuel phase is drawn out from the top of the settling tank. In the process of the Sweet '454 patent, the membrane separator is used to assist a gravity phase separation process.

In Applicant's invention, the membrane separator and the water-settling chamber are two independent components. The membrane separates stabilized emulsified water from the fuel directly without flowing the permeate back to the water-settling chamber. In Applicant's invention, the water-settling chamber is responsible for separating the larger water droplets from the fuel. The water-settling chamber and the recirculating retentate do not separate the stabilized emulsified water from the fuel. In the settling chamber of Applicant's invention, contrary to that of Sweet '454, there is no separation of the stabilized emulsion. The separation taking place in the Sweet '454 settling tank is a gravitational forced separation. In fact, Sweet '454 teaches

away from using either a settling tank or a membrane separator alone, or a combined membrane and settling tank process in series (see column 6, lines 31-33 of Sweet '454).

Examiner has rejected Claim 2 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

Applicant's fuel filter is an unique apparatus for the separation of highly emulsified fluids. Neither Williamson '724 nor Sweet '454, nor other existing art teaches such a device for the separation of highly emulsified fluids. Therefore, the specification of design and operating parameters to further protect Applicant's invention is justifiable.

Examiner has rejected Claim 3 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

Williamson (column 9, lines 59 – column 10, line 21) describes how to calender a medium to a desired thickness under pressure to control filter bubble point. As such, it is a process of manufacturing a calendered filter medium. In Applicant's invention, it is the differential pressure greater than a specified value that causes water to pass through the membrane with the fuel. This is an unusual phenomenon in membrane filtration applications. Therefore the limitation of the differential pressure is not to optimize a known process, but rather is a non-obvious invention of Applicant.

Examiner has rejected Claim 4 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

Applicant has discovered that operating temperature can greatly affect the water removal efficiency of the membrane. Above 130°F, water will pass through the membrane with the fuel; thus, the limitation is an invention of Applicant and not a modification of a known process. Applicant maintains the temperature below 130°F, a temperature that is likely well above ambient, to prevent passage of water with the fuel.

Examiner has rejected Claim 5 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

Williamson '724 (column 15, lines 21-40) prefers polyethylene terephthalate and polybutylene terephthalate. Both are co-polymers in the polyester family and have a surface tension of approximately 50 dynes/cm, a surface tension characteristic of hydrophilic materials. Applicant's invention utilizes polymers having a surface tension as close as possible to that of the fuel, namely, 30 dynes/cm, a surface tension characteristic of hydrophobic materials. Williamson '724 further teaches the use of these above-referenced membrane materials to coalesce water in fuel in order to allow removal via gravity. Williamson '724 does not teach Applicant's invention of regrouping water emulsion into a micron-size range.

Examiner has rejected Claim 6 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

Applicant's fuel filter is an unique apparatus for the separation of highly emulsified fluids. Neither Williamson '724 nor Sweet '454, nor other existing art teaches such a device for the separation of highly emulsified fluids. Therefore, the specification of design and operating parameters to further protect Applicant's invention is justifiable.

Examiner has rejected Claim 7 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

> The separating element of Williamson '724 is a pleated dead-end filter. The separating element of Applicant is a cross-flow filter and is not pleated. In fact, as a cross-flow filter, Applicant's filter must be hollow fiber, spiral wound or tubular filter, not a pleated filter. Williamson '724 does not teach cross-flow (i.e., using gravity to remove coalesced water from fuel). Therefore, the coalescing element and the separating element of Williamson '724 must be placed vertically. Applicant's invention may be placed in any orientation, since it operates via cross-flow.

Examiner has rejected Claim 8 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

> Williamson '724 uses a separating element of a pleated cartridge having calendered PTFE fibers or a 100 x 100 mesh coated with PTFE. Applicant utilizes a sub-micron membrane of PTFE to form the cross-flow filter element. Further, Williamson '724 does not teach how to remove micron-size water emulsion from fuel using any PTFE filter.

Examiner has rejected Claims 9 and 10 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

> Williamson '724 (column 6, lines 32-38) describes a "well-published" wetting phenomenon using a wetting liquid on 0.2 micron PTFE filter sheet. There is no published information, and Williamson '724 does not disclose such, relating to removal of water emulsions from fuel using a 0.2 micron PTFE filter sheet. The

ultra-filtration and micro-filtration membranes of Sweet '454 require combination with a settling tank in order to generate a light phase that may be drawn from the settling tank.. Sweet '454 does not teach a micron pore membrane with a similar surface tension to the light phase (fuel) for separation of the heavy phase from the light phase. Sweet '454 teaches away using a settling tank or a membrane separator alone or a combined membrane-settling tank process operated in series (column 6, lines 31-33). Sweet '454 specifically teaches that the permeate from the membrane separator should be recirculated through a settling tank (FIG. 1). Applicant's invention uses a PTFE micro-filtration membrane to remove water emulsion from the fuel directly without sending the filtered fuel (permeate) back to the settling tank. The filtered fuel from the PTFE membrane element is the final product (light phase). Applicant's settling chamber does not generate a light phase (fuel). It is only utilized to remove larger water droplets.

Examiner has rejected Claims 18 and 19 over Williamson '724 in view of Sweet '454. Applicant respectfully traverses Examiner's rejection and request Examiner to consider the following arguments.

Neither Williamson '724 nor Sweet '454, nor any existing art teaches a device for the separation of highly emulsified fluids. The specification of design and arrangement of multiple filter elements to further protect the invention is justifiable. Williamson '724 teaches use of a flat partition plate to isolate the first filter element group from the second filter element group, or the utilization of flat circular plates to blank the ends of the first and second filter elements. Applicant's invention places each second membrane in its own inner housing (See FIG. 2A, #52). The inner housings are utilized to separate the first filter elements from the second filter elements.

Williamson '724 teaches two dead-end filters in series with a flow direction in the first filter from inside to outside and a flow direction in the second filter from outside to inside. Placing different types of filter elements with different flow patterns in the

same filter arrangement can have different functional results. Applicant's invention is a hydrophobic dead-end filter followed by a hydrophobic cross-flow membrane filter. The first filter flow direction is from inside to outside, but the flow in the second filter is bi-directional, with the permeate flowing from outside to inside and the retentate flowing in one end and out the other end. Further, Williamson does not teach separate enclosures for series filter elements.

Summary

In view of Applicant's foregoing arguments distinguishing over Williamson '724 and Sweet '454, Applicant respectfully submits that Claim 1 is in condition for allowance and Examiner's rejection of Claims 2-10 depending from Claim 1 is now moot.

Additionally, and in view of Applicant's foregoing arguments distinguishing over Williamson '724 and Sweet '454, Applicant respectfully submits that Claims 18 and 19 are in condition for allowance.

CONCLUSION

Applicant respectfully believes the present application is now in condition for allowance and requests reconsideration thereof. If Examiner disagrees with Applicant's position and would like to receive further clarifying explanations of the significance of Applicant's invention, it is respectfully requested that Applicant be granted a telephone interview with Examiner.

Otherwise, should the Examiner have any questions regarding this submission, he is invited to contact the undersigned counsel at the telephone number below.

{Signature follows}

Respectfully submitted, this 28th day of October, 2003,

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